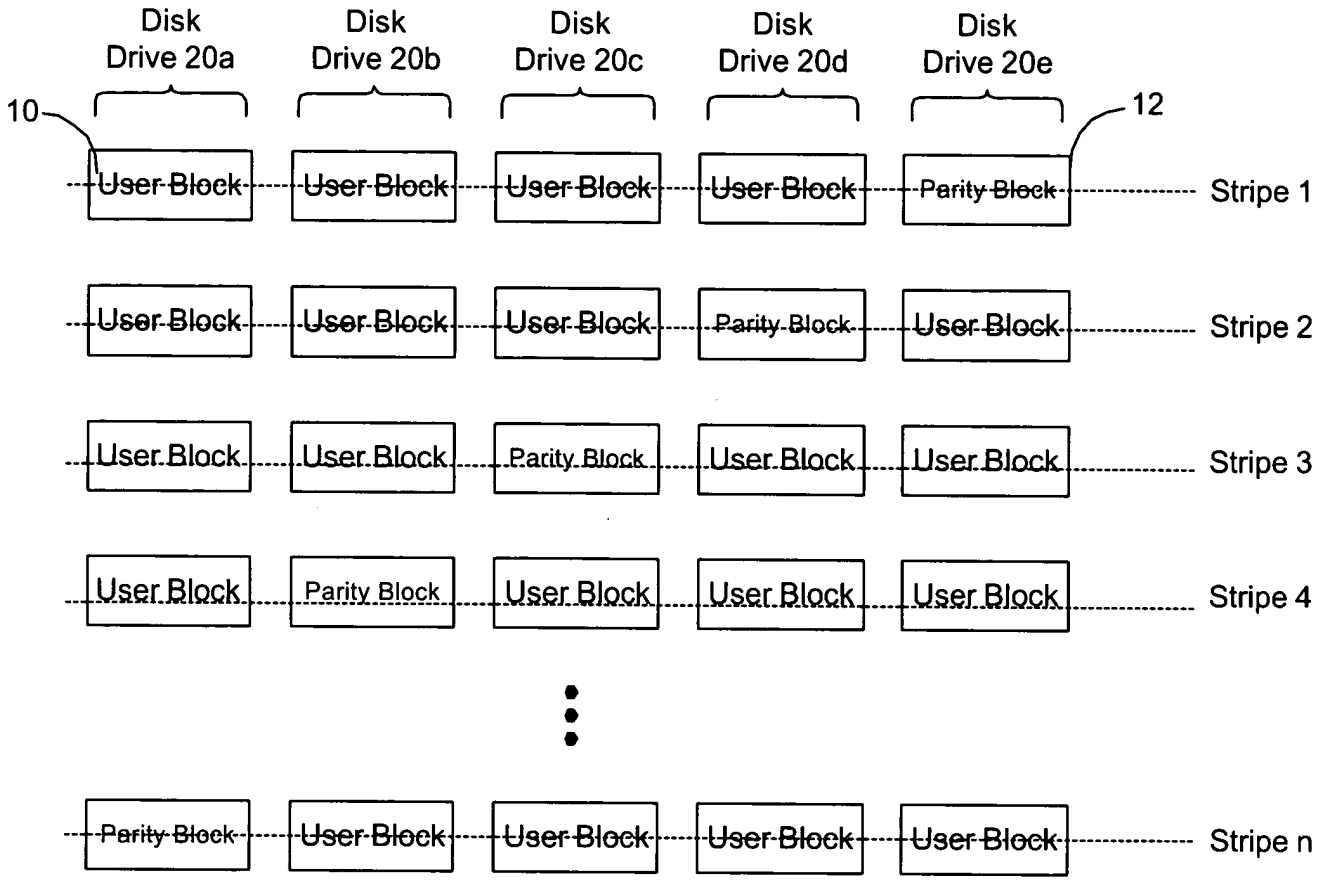


FIG. 1
Prior Art

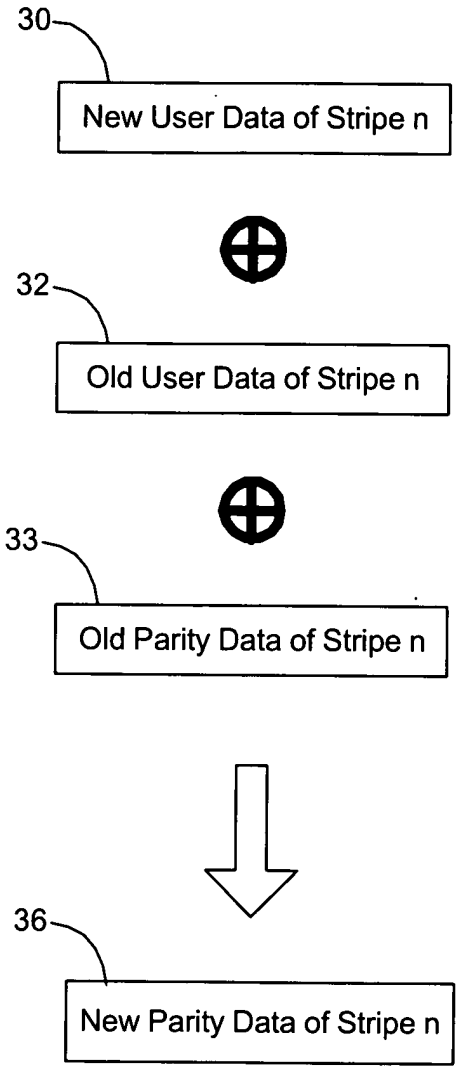


FIG.2
Prior Art

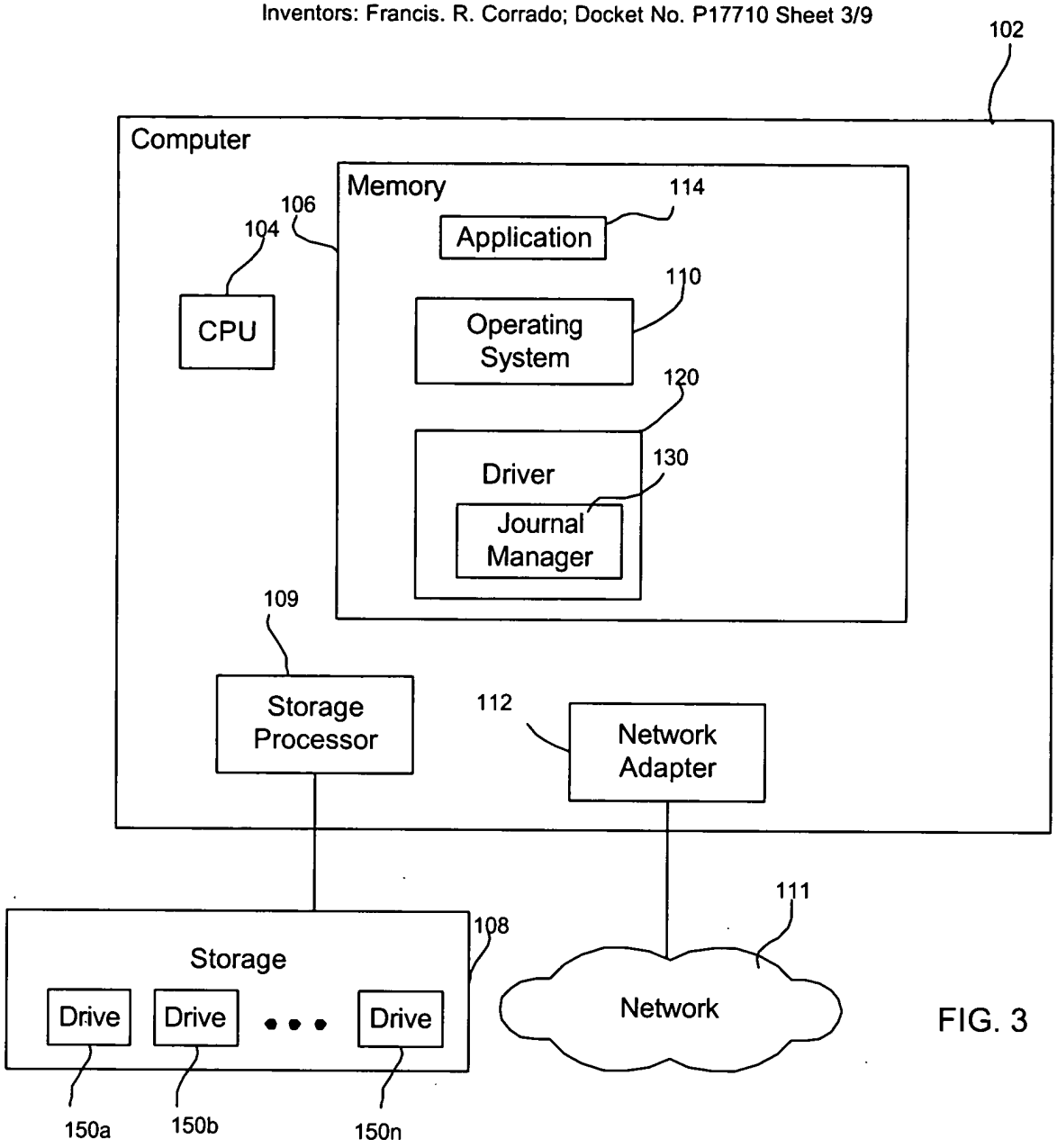
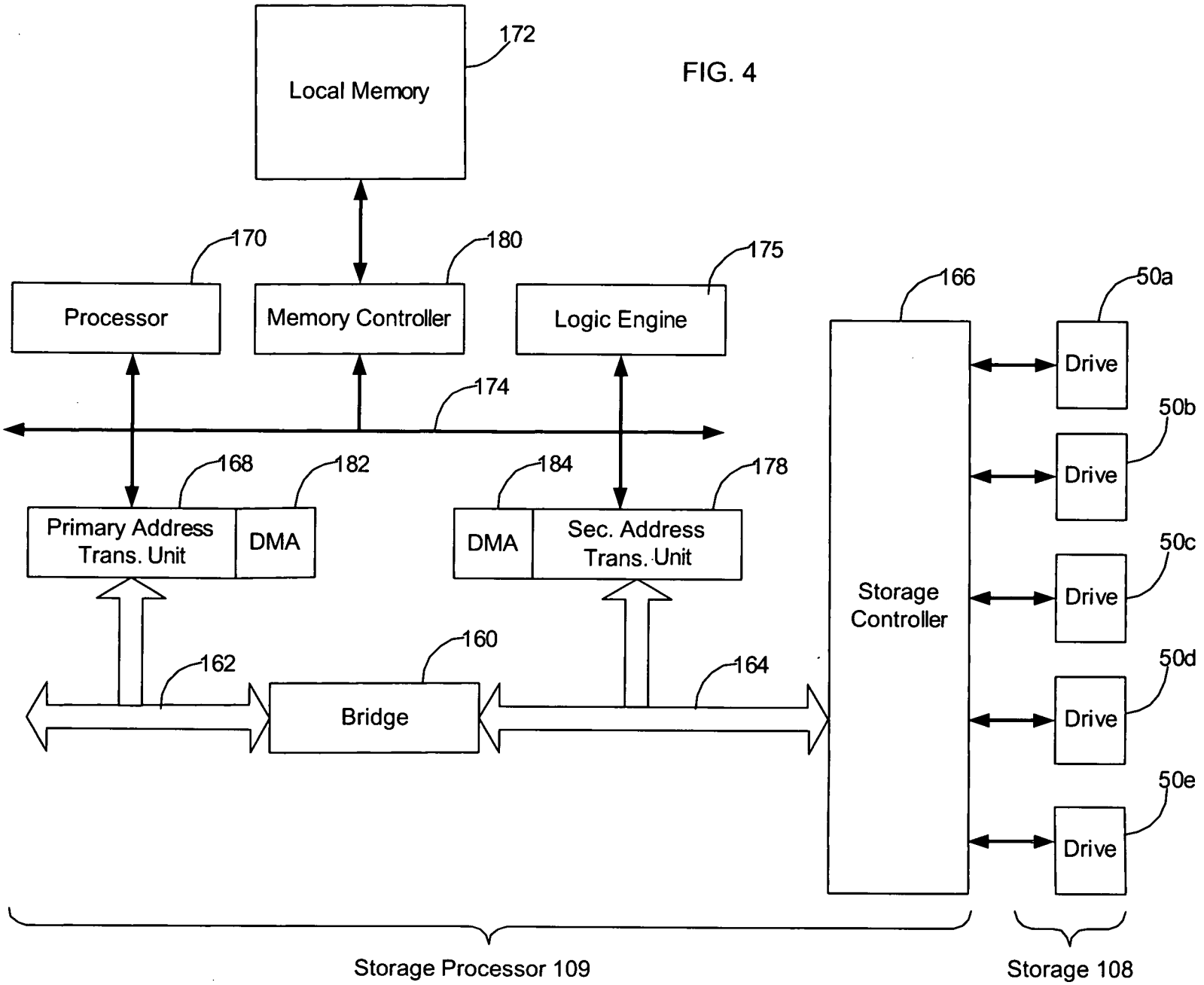

102
Computer
Memory
114
Application
106
104
CPU
110
Operating System
120
Driver
130
Journal Manager
109
Storage Processor
112
Network Adapter
111
108
Storage
Drive
Drive
Drive
Network
150a
150b
150n

FIG. 3

FIG. 4


Local Memory
172
170
180
175
Processor
Memory Controller
Logic Engine
174
168
182
184
178
Primary Address Trans. Unit
DMA
DMA
Sec. Address Trans. Unit
162
160
164
Bridge
166
Storage Controller
50a
Drive
50b
Drive
50c
Drive
50d
Drive
50e
Drive
Storage Processor 109
Storage 108

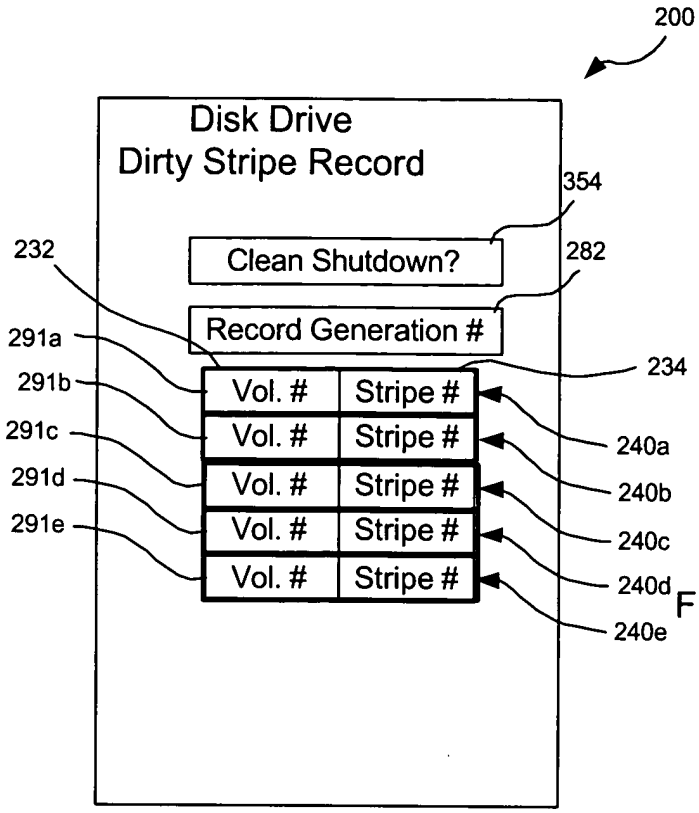


FIG. 5A

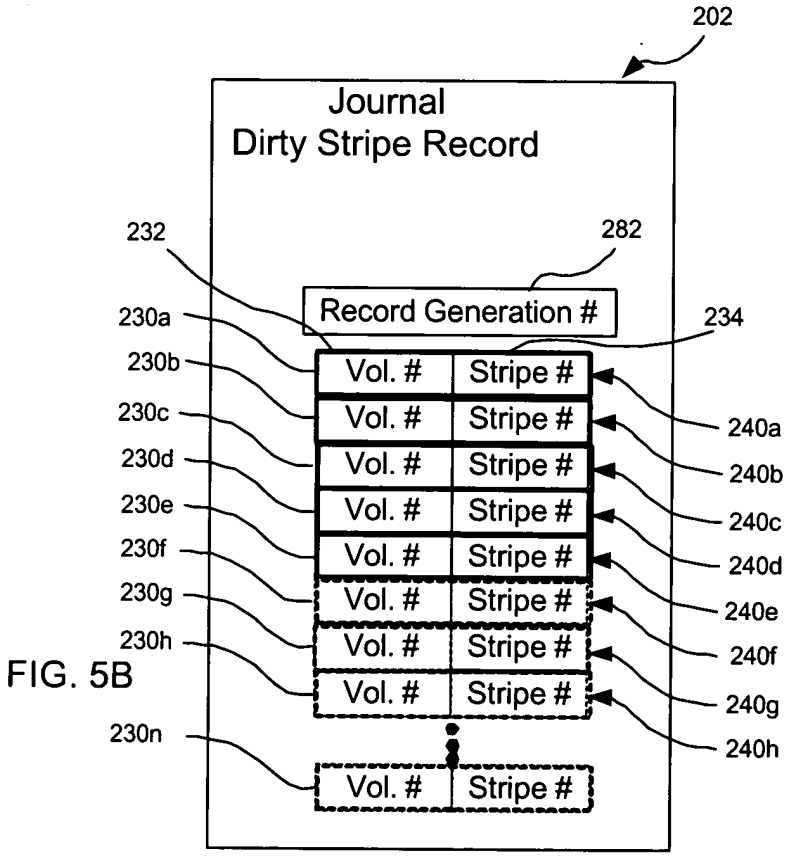


FIG. 5B

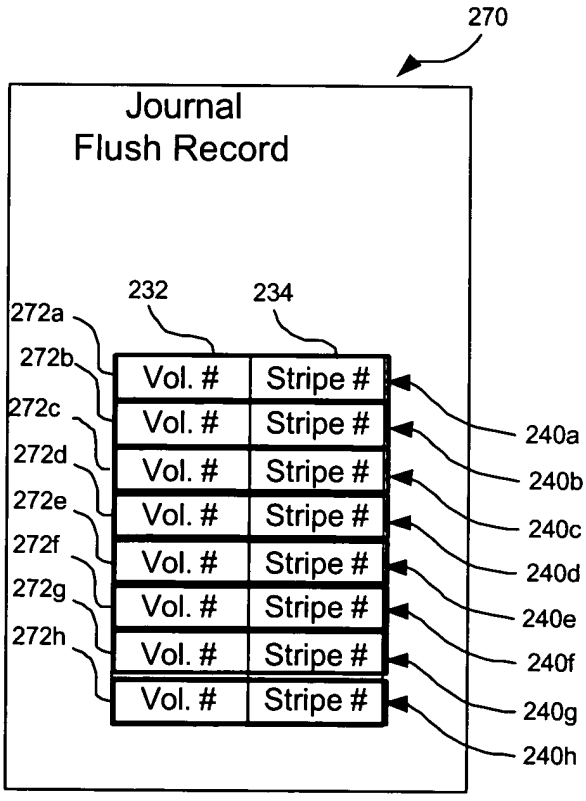
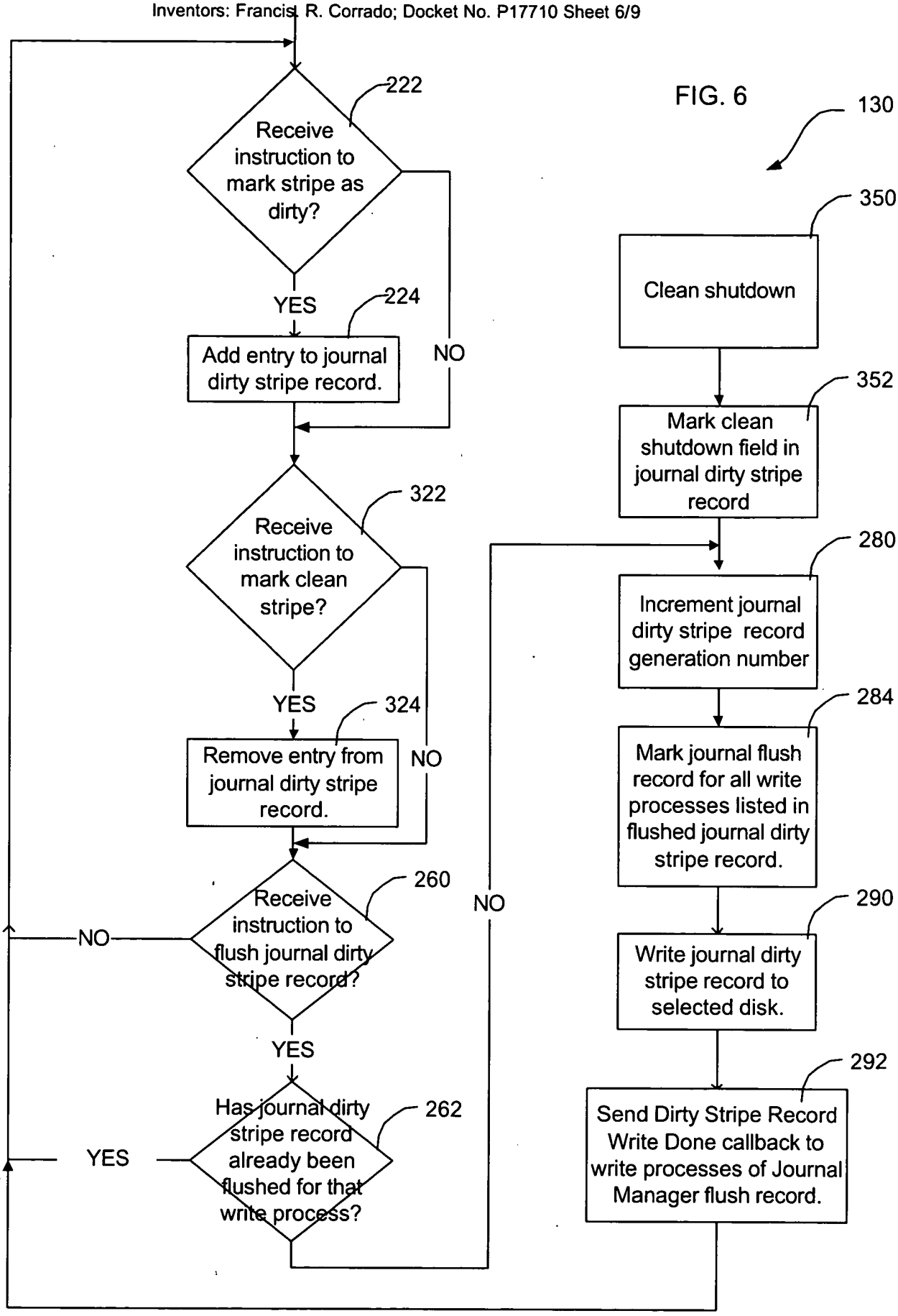


FIG. 9

FIG. 6


130
222
Receive instruction to mark stripe as dirty?
YES
NO
224
Add entry to journal dirty stripe record.
322
Receive instruction to mark clean stripe?
YES
NO
324
Remove entry from journal dirty stripe record.
260
Receive instruction to flush journal dirty stripe record?
NO
YES
262
Has journal dirty stripe record already been flushed for that write process?
YES
NO
350
Clean shutdown
352
Mark clean shutdown field in journal dirty stripe record
280
Increment journal dirty stripe record generation number
284
Mark journal flush record for all write processes listed in flushed journal dirty stripe record.
290
Write journal dirty stripe record to selected disk.
292
Send Dirty Stripe Record Write Done callback to write processes of Journal Manager flush record.

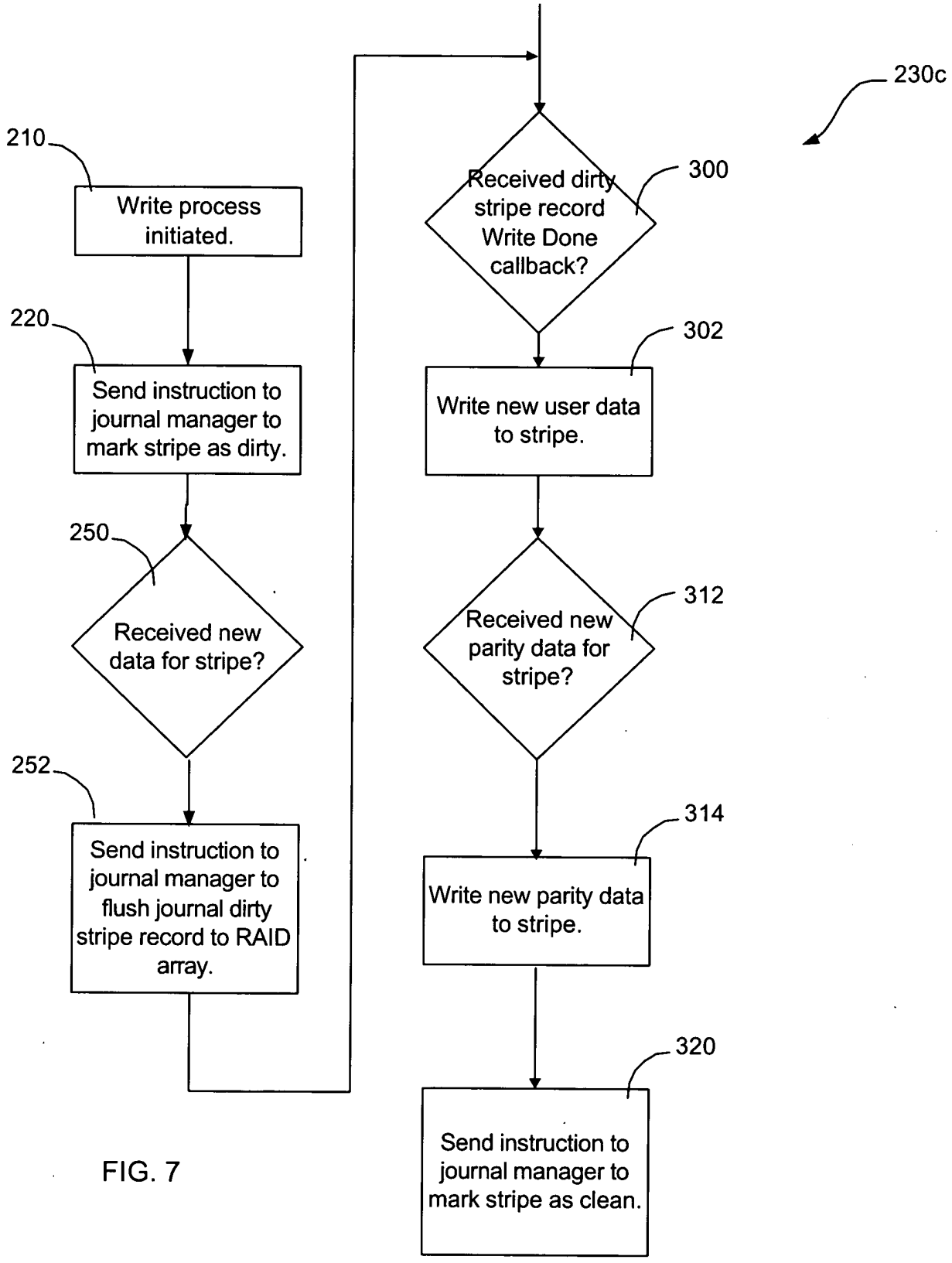

230c
210
Write process initiated.
220
Send instruction to journal manager to mark stripe as dirty.
250
Received new data for stripe?
252
Send instruction to journal manager to flush journal dirty stripe record to RAID array.
300
Received dirty stripe record Write Done callback?
302
Write new user data to stripe.
312
Received new parity data for stripe?
314
Write new parity data to stripe.
320
Send instruction to journal manager to mark stripe as clean.

FIG. 7

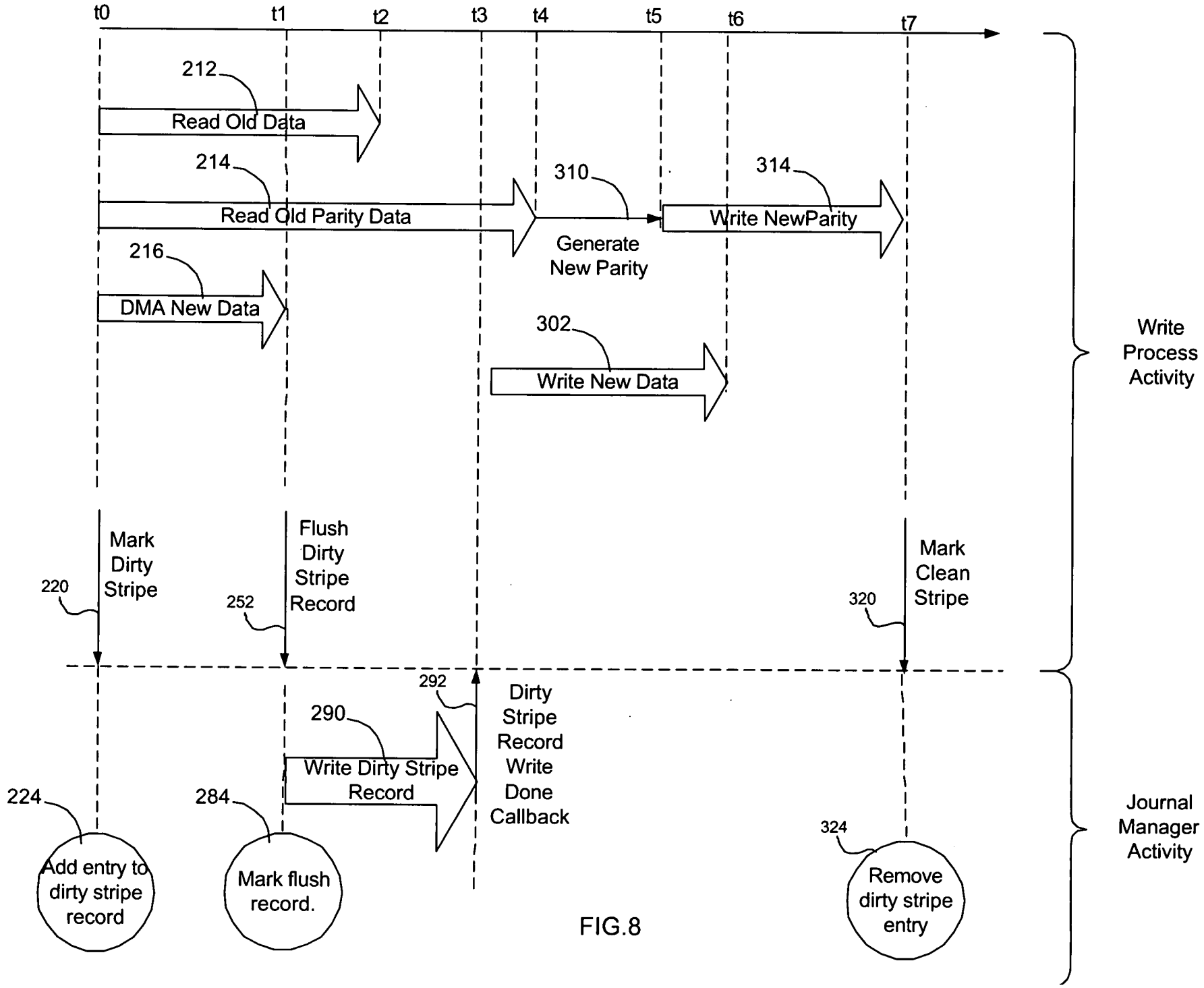

t0
t1
t2
t3
t4
t5
t6
t7
212
Read Old Data
214
Read Old Parity Data
310
Generate New Parity
314
Write NewParity
216
DMA New Data
302
Write New Data
Write Process Activity
Mark Dirty Stripe
220
Flush Dirty Stripe Record
252
Mark Clean Stripe
320
292
Dirty Stripe Record Write Done Callback
290
Write Dirty Stripe Record
224
284
Add entry to dirty stripe record
Mark flush record.
324
Remove dirty stripe entry
Journal Manager Activity

FIG.8

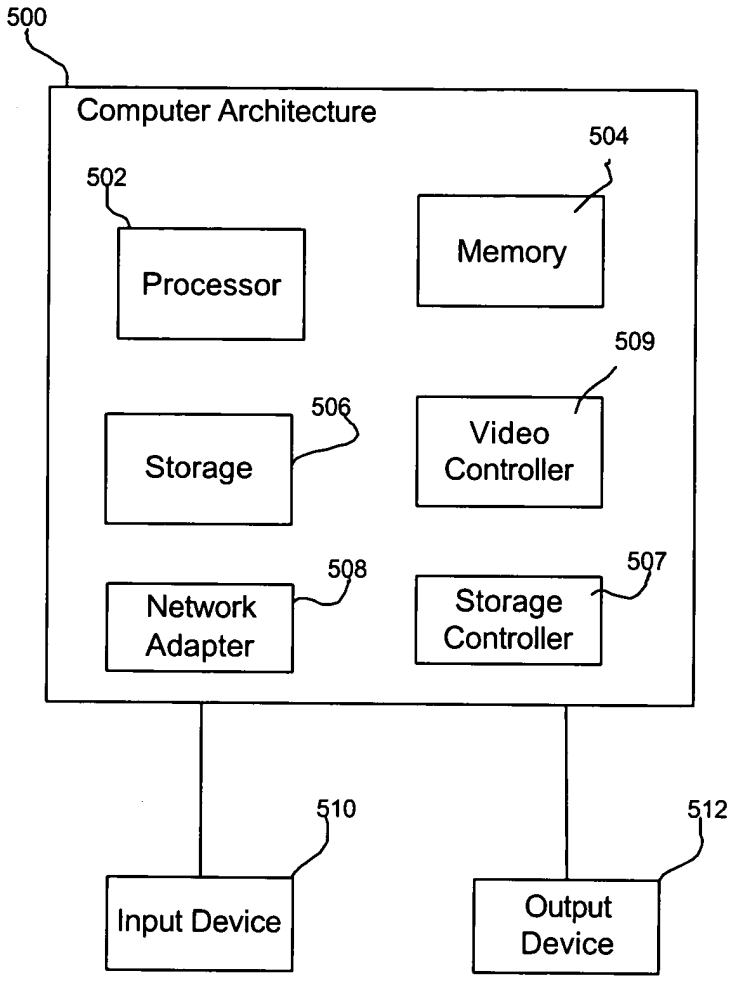

500
Computer Architecture
502
Processor
504
Memory
506
Storage
509
Video Controller
508
Network Adapter
507
Storage Controller
510
Input Device
512
Output Device

FIG. 10